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ESTIMATION OF "INVISIBLE" R&D:

AN EXPLORATORY MODEL

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INTRODUCTION

Total expenditures on research and development within a country, GERD (gross domestic expenditure on R&D), is an indicator of the level of R&D activity. These expenditures are an important measurement, since they also provide an indication of the production of new scientific and technical knowledge. In this context, it is reasonable to assume that the new scientific and technical knowledge which enters a country in a relatively free manner has an affect on the interpretation of these statistics.

For example, a contribution is made to the increase of new knowledge in a country when the results of basic research are acquired through scientific journals, research conferences, symposiums and seminars. Thus, we have access not only to research conducted in our own universities and research institutes, but also to the results of research conducted elsewhere. Of course, this does mean that it would be possible to depend on research conducted elsewhere. The contrary is true: if we wish to be in a position to understand and apply new knowledge originating abroad, we must have a high level of research within the country.

University research is distributed freely; the above example therefore represents a normal state of affairs for all countries. This also means that the effect of this relatively free entry of new knowledge affects statistical interpretations of GERD, in the same way for all countries. However, Canada is also the recipient of a significant volume of knowledge of the "intellectual property" type derived from R&D conducted by foreign companies. If we were obliged to pay for and measure this type of knowledge in the same way as we record domestic R&D, we could add this value to GERD, in order to determine the level of new knowledge available in the country.

Since a large proportion of Canadian companies are under foreign control, and, in particular, under U.S. control, they benefit from cross-border flows of technological information. A significant proportion of these transfers is not recorded by statistical surveys, since the transfers are between parent companies and subsidiaries(1). The purpose of this working paper is to estimate the putative value of these transfers, of the statistically invisible R&D.

METHOD

The method used to estimate invisible R&D is derived basically from that developed by Professor Reddaway in his study **Effects of UK Direct Investment Overseas,** Cambridge (1968), and from the model used in a technical document of the Ministry of State for Science and Technology, **Importation of Invisible Research and Development, 1974-1976** (July 1978).

The model attempts to estimate the value of R&D transfered from foreign parent companies to Canadian subsidiaries which is not otherwise recorded in statistical surveys. In view of the lack of complete statistical data, it is possible to calculate invisible technology transfers only by treating these payments as equivalent to the residual value of an estimation process.

Basic hypotheses

The entire procedure for estimating invisible R&D depends on the following basic hypotheses:

- First, that all technologies used by Canadian subsidiaries are similar to those used by parent companies manufacturing similar products.

- Next, it is assumed that all the subsidiaries, in order to remain competitive, require a level of R&D, measured as a percentage of sales (or added value), similar to that of their parent company.

- Last, where the subsidiary's R&D level is inferior to that of the parent company, it is assumed that technology is being transferred from the parent company to the subsidiary in order to maintain the latter's competitiveness.

From these basic hypotheses, it is estimated that the R&D level required by Canadian subsidiaries in order to maintain their sales is proportionate to the R&D required by the parent company to maintain its sales. In formal terms, this type of R&D is then categorized as "potential R&D" (R_{pot}):

$$R_{pot} = \frac{\text{Parent company annual R\&D}}{\text{Parent company annual sales}} \times \text{Annual sales of subsidiary}$$

From this estimate, it is possible to deduce the "invisible" R&D by deducting all visible sources of R&D:

R_{dom} = R&D actually developed or purchased in Canada annually by the subsidiary

R_{tra} = Payments made to acquire technology from non-Canadian sources

The "invisible" R&D (Rinv) is obtained residually through the following equation:

$$R_{inv} = R_{pot} - (R_{dom} + R_{tra})$$

Before considering estimates for this equation, we will attempt to establish the bases of the hypotheses underlying the model.

It can be seen from Table 1 that the level of R&D, measured as a percentage of sales, of Canadian manufacturing industries is less than that of the United States. In fact, apart from certain industries such as textiles, aircraft and aircraft parts, telecommunication equipment and other manufacturing industries, the U.S. ratio of R&D/sales is clearly superior to the Canadian level. Furthermore, Table 2 indicates that the level of R&D/sales of foreign-controlled companies is less than that of Canadian-controlled companies. According to the basic hypotheses explained above, this means that Canadian subsidiaries must import a proportion of their R&D in order to remain competitive.

Table 1. Self-funded Current R&D Expenditures of Companies in the U.S.A. and Canada, as Percentage of Sales

Industry	Canada 1984	U.S.A. 1983
	%	
Food, beverage and tobacco	0.4	0.4
Rubber and plastic products	0.8	2.2
Textiles	1.2	0.5
Wood	0.8	0.8
Pulp and paper	0.3	1.1
Primary metals (ferrous)	0.5	0.7
Primary metals (non-ferrous)	0.5	1.1
Fabricated metal products	0.9	1.4
Machinery	2.0	5.0
Aircraft and parts	10.1	3.9
Other transportation equipment	0.3	1.0
Telecommunication equipment	13.4	8.5
Electronic parts and components	4.9	6.5
Other electronic equipment	7.3	..
Business machines	1.5	9.9
Other electrical products	1.4	3.3
Non-metallic mineral products	0.6	1.4
Refined petroleum and coal products	0.5	0.7
Drugs and medicines	4.0	7.6
Other chemical products	1.2	2.3
Scientific and professional equipment	1.8	8.8
Other manufacturing industries	1.5	0.9
All manufacturing industries	**1.2**	2.6

Sources: Statistics Canada, Science, Technology and Capital Stock Division; National Science Foundation, **Research and Development in Industry, 1933**, Table B-22.

Table 2. Self-funded Current R&D Expenditures of Canadian Manufacturing Companies as a Percentage of Sales, by Country of Control, 1984

Industries	Canadian control	Foreign control
	%	
Food, beverages and tobacco	0.2	0.6
Rubber and plastic products	1.6	0.5
Textiles	..	..
Wood	0.8	-
Pulp and paper	0.4	0.3
Primary metals (ferrous)	..	..
Primary metals (non-ferrous)	0.5	0.1
Fabricated metal products	0.9	0.9
Machinery	3.0	0.8
Aircraft and parts	..	..
Other transportation equipment	1.6	0.3
Telecommunication equipment	..	..
Electronic parts and components	12.4	3.1
Other electronic equipment	13.4	3.5
Business machines	13.1	0.9
Other electrical products	2.1	1.3
Non-metallic mineral products	0.3	0.9
Refined petroleum and coal products	..	..
Drugs and medicines	13.9	3.0
Other chemical products	1.7	1.1
Scientific and professional equipment	9.0	1.3
Other manufacturing industries	1.7	1.0
All manufacturing industries	**1.6**	**0.9**

Source: Statistics Canada, Science, Technology and Capital Stock Division.

Moreover, a review of existing statistics indicates that, in Canada, only 5% of Canadian firms and corporations are of foreign origin. However, their sales represent more than 50% of total sales of the manufacturing sector. It can be seen from Table 3 that in 1983 74% of these foreign corporations were of U.S. origin, and that these corporations alone account for 80% of sales of foreign companies. These companies of U.S. origin represent only 4% of the total number of firms, but their sales exceed 40% of total sales in Canada.

Despite the small number of American-controlled firms as a proportion of all firms in Canada, the volume of their sales indicates that they are large in size. It is reasonable to assume that large companies conduct R&D and are more likely to make intra-company transfers. It would appear, therefore, that the data on sales of U.S.-controlled companies are important and can be used as a basis for estimating the R&D potential of Canadian subsidiaries by reference to their parent companies.

Table 3. Geographical Distribution of Number and Sales of Companies of the Canadian Manufacturing Sector, for 1982 and 1983

Countries	Number of Companies		Sales	
	1982	1983	1982	1983
	number		millions of dollars	
United States	1,493	1,367	82,813	92,610
United Kingdom	249	205	11,111	9,615
France	36	30	1,902	1,822
West Germany	72	65	1,251	1,265
Netherlands	25	22	4,567	4,854
Japan	14	12	423	477
Other Foreign	171	154	3,964	4,697
Total Foreign	**2,060**	**1,855**	**106,031**	**115,341**
Canadian	36,501	36,446	108,136	113,872
Total	**38,561**	**38,301**	**214,167**	**229,213**

Source: **Corporations and Labour Unions Returns Act 1983**, Statistics Canada Catalogue No. 61-210, March 1986, page 135, Table 3.

APPLICATION OF THE MODEL

The model was applied experimentally to two manufacturing industries: transportation equipment and chemicals. These industries were chosen because of their high level of foreign control. Table 4 shows that 7% of the companies in the transport equipment industry are U.S.-controlled and that their sales represent 83% of the Canadian total. Of Canadian companies in the chemicals industry, 19% are U.S.-controlled and their sales represent 58% of the Canadian market.

The first stage of the estimation process consists of identifying American parent companies which conduct R&D. For this purpose, we have used a Business Week survey published on July 9, 1984, which identified about 800 private companies with total sales of $35 million which spend at least $1 million or 1% of sales on R&D. The article refers to these parent companies as leading the way in R&D in the United States.

In the second stage, we determined which parent companies have Canadian subsidiaries. From **Inter-Corporate Ownership, 1982,** we can identify the Canadian subsidiaries of these parent companies. We can then quantify the potential R&D (Rpot) by reference to the sales of the parent companies and the Canadian subsidiaries.

The data for domestic R&D (Rdom) are taken from the annual survey of enterprises engaged in or funding R&D, carried out by the Science and Technology Statistics Section of Statistics Canada. The technology transfer calculation was based on data on royalties and payments made by Canadian firms to non-residents, in respect of patents of invention, scientific research and product and process development research(2).

Table 4. Number and Sales of Corporations in Canada by Country of Control, Manufacturing Sector, 1983

Industry	United States		Others Foreign		Canadian		Total	
	Number	Sales	Number	Sales	Number	Sales	Number	Sales
		$000,000		$000,000		$000,000		$000,000
Foods	82	6,772	37	1,781	3,590	24,371	3,709	32,924
Beverages	16	1,178	7	580	230	3,043	253	4,801
Tobacco products	4	439	4	854	4	2	12	1,296
Rubber products	25	2,437	11	505	109	341	145	3,283
Leather products	12	x	2	x	448	1,001	462	1,247
Textile mills	8	2,241	26	557	894	2,562	958	5,359
Knitting mills	4	133	3	24	261	812	268	968
Clothing industries	23	441	5	19	2,476	3,967	2,522	4,427
Wood industries	34	867	10	188	3,022	6,583	3,066	7,638
Furniture industries	24	352	7	12	2,235	2,110	2,266	2,474
Paper and allied products	47	3,017	19	1,968	550	13,430	616	18,415
Printing, publishing and allied	38	656	26	298	5,379	6,681	5,443	7,636
Primary metals	27	874	14	950	346	8,991	387	10,815
Metal fabricating	205	3,337	57	788	5,911	8,707	6,173	12,832
Machinery	166	2,786	49	593	1,563	3,070	1,778	6,449
Transportation equipment	104	30,270	23	1,566	1,295	4,497	1,422	36,332
Electrical products	112	5,717	30	1,426	1,092	4,171	1,234	11,313
Non-metallic mineral products	39	1,426	30	1,290	1,466	2,409	1,535	5,125
Petroleum and coal products	11	17,417	5	5,382	70	8,729	86	31,528
Chemicals and chemicals products	193	9,461	70	2,928	771	3,851	1,034	16,240
Miscellaneous manufacturing	163	x	53	x	4,734	4,548	4,950	8,111
Total, Manufacturing industries	**1,367**	**92,610**	**488**	**22,731**	**36,446**	**113,872**	**38,301**	**229,213**

Source: Statistics Canada, Industrial Organization and Finance Division.

The model was applied to all Canadian subsidiaries controlled by a parent company identified as a leader in R&D in the United States in the transportation equipment and chemicals industries. However, it should be noted that, because of actual R&D expenditures and transfer payments greater than potential R&D, some subsidiaries have a negative "invisible" R&D. These negative values were included unchanged in the compilation, in order to minimize possible overestimation of "invisible" R&D.

RESULTS

We used a special compilation to determine (see Table 5) that in 1982 payments to non-residents(3) totalled $125 million for the transportation equipment manufacturing industry. This figure represents the total payment for patents of invention, scientific research and product and process development research for this manufacturing industry. The total might be different if a larger number of potential transfer payments were included. For example the following types could be regarded as various forms of technology transfer payments(4): industrial designs, trademarks and trade names, other royalties, management and administrative fees, engineering services and, possibly, consulting fees (an additional $920 million).

However, until there is a sound basis for including all these payment types in the model, we will use only the following three types: patents of invention, scientific research, and product and process development research.

Invisible R&D represents $1,039 million for the transportation equipment manufacturing and chemicals industries in 1983. This is indicated by Tables 5 and 6, which summarize the invisible R&D calculations for these two industries. The tables include the ten parent companies in each industry with the largest sales, and details of the calculations.

Table 5. Calculation of "Invisible" R&D for the transportation Equipment Industry, 1983

	Parent Company				Canadian Subsidiary				
1	2	3	4	5	6	7	8	9	10
Rank by sales	Name	Sales	R&D	Ratio (4/3)	Sales	Rpot (5*6)	Rdom	Rtra	Rinv (7-(8+9))
		$000,000 US		%			$000,000 CDN		
1	General Motors	74,582	2602	3.5					
2	Ford Motors	44,455	1751	3.9					
3	United Technologies Corporation	14,669	971	6.6					
4	Chrysler	13,240	365	2.8					
5	The Boeing Company	11,129	429	3.9					
6	Allied Corporation	10,022	280	2.8					
7	Goodyear Tire & Rubber Co.	9,736	251	2.6					
8	McDonnell Douglas Corp.	8,111	301	3.7					
9	Rockwell International Corp.	8,098	254	3.1					
10	Signal Companies Inc.	6,074	204	3.4					
	Other	117,525	7,408	6.3					
	Total	317,641	11,384	3.6	31,002	1,077	126	125	827

Source: "A Deepening Commitment To R&D", Business Week, July 9, 1984. Statistics Canada, Inter-Corporate Ownership, 1982, Catalogue No. 61-517. "Getting The Most From The Top 500", Canadian Business, June 1984. "Survey of Industries '84" The Financial Post. Statistics Canada, Science Technology and Capital Stock Division, and Industrial Organization and Finance Division.

Table 6. Calculation of "Invisible" R-D for the Chemicals and Chemical Products Industry, 1983

	Parent Company				**Canadian Subsidiary**				
1	2	3	4	5	6	7	8	9	10
Rank by sales	Name	Sales	R&D	Ratio (4/3)	Sales	Rpot (6*5)	Rdom	Rtra	Rinv (7-(8+9))
			$000,000 US	%			$000,000 CDN		
1	E.I. Du Pont De Nemour and Company	35,378	966	2.7					
2	Standard Oil Co. of California	27,342	251	0.9					
3	Gulf Oil Corporation	26,581	143	0.5					
4	Occidental Petroleum Corporation	19,116	51	0.3					
5	United Technologies Corporation	14,669	970	6.6					
6	Procter and Gamble Co.	12,452	327	2.6					
7	Dow Chemicals Co.	10,951	492	4.5					
8	Allied Corporation	10,022	280	2.8					
9	Union Carbide Co.	9,001	245	2.7					
10	Ashland Oil Co.	7,852	16	0.2					
	Other	140,334	4,911	3.5					
	Total	**313,698**	**8,653**	**2.8**	**10,118**	**340**	**82**	**46**	**212**

Source: "A Deepening Commitment To R&D", Business Week, July 9, 1984. Statistics Canada, **Inter-Corporate Ownership, 1982,** Catalogue No. 61-517. "Getting The Most From The Top 500", Canadian Business, June 1984. "Survey of Industries '84" The Financial Post. Statistics Canada, Science Technology and Capital Stock Division, and Industrial Organization and Finance Division.

Potential R&D is estimated to be $1,077 million for the transportation equipment industry; after adjustments for payments for R&D conducted in Canada and the purchase of foreign R&D, the resulting "invisible" R&D is $827 million, which represents R&D expenditures three times greater than the reported expenditures identified of the U.S. subsidiaries(5). In the case of the chemicals industry (see Table 6), potential R&D is $340 million. After adjustments for expenditures R&D, the "invisible" R&D figure is $212 million. This represents a possible value of R&D received by the subsidiary almost twice as great as the identified expenditures of the U.S. subsidiaries(6).

On the basis of the hypotheses in this model, "invisible" R&D for these two industries could be $1,039 million. This is a large amount for only two manufacturing industries. We can ask whether other manufacturing industries may also have invisible R&D on this scale. This could be answered only by application of the model to the other manufacturing industries. It is plausible to assume that the extend of control of the industry by U.S. parent companies is a significant factor. However, this hypothesis has not been proved.

CONCLUSION

Using the exploratory model, we have attempted to evaluate the potential cost of technology acquired by Canadian subsidiary firms as a result of R&D conducted abroad by their parents. The estimation procedure employed is based on the hypothesis that R&D conducted in the United States by parent companies is relevant to subsidiaries in proportion to their sales. Application of the model applied to two industries resulted in "invisible" R&D of $1,039 million estimated in 1983, or almost five times the level of R&D conducted by the subsidiaries in Canada.

In view of the hypotheses implicit in the model, the results must be interpreted with great caution. Certain hypotheses can have a direct effect on the results of the model. It is, for example, highly probable that the subsidiaries do not use the same level of technology as the parent company, and this will result in an overestimate of "invisible" R&D. Moreover, it may be assumed that the degree of control in the hands of the parent company will have an effect on the transfer of R&D to the subsidiary(7). Again, the fact that the sample consists essentially of U.S. parent companies ignores the possible effect of non-U.S. parent companies.

Industry statistics for R&D accurately reflect R&D activities in Canada, but certainly underestimate the intra-industry flow of production of new knowledge resulting from R&D. It may therefore be desirable, in comparing Canadian R&D statistics with those of other countries, to bear in mind that there are substantial unrecorded technology transfers from parent companies to Canadian subsidiaries.

NOTES

(1) Or the technology transfers may be reported in the statistical surveys, but under general headings (for example management and administrative fees).

(2) Source: Statistics Canada, Industrial Organization and Finance Division. Unpublished figure for fiscal 1982.

(3) Payments made to residents of the U.S.A. by all Canadian firms (Rtra). Since 1982 is the last year for which we have data for all payment types, we have used it in our estimates for 1983.

(4) The various payment types are shown in Table 4 of the Appendix.

(5) Total of columns 8 and 9 of Table 5.

(6) Total of columns 8 and 9 of Table 6.

(7) A factor reflecting the percentage of control of the subsidiary by the foreign parent company could be incorporated in the potential R&D calculation as follows:

$$Rpot = \frac{\text{Parent company annual R\&D}}{\text{annual sales}} \times \text{Annual sales of subsidiary} \times \text{Percentage of control of subsidiary by parent company}$$

APPENDIX

Technical Note

There are few data on technology transfers. It is, however, possible to identify some transfers through use of the following sources of data:

- Surveys of the Science and Technology Statistics Section;
- surveys of the Balance of Payments Sub-division, and
- statistics compiled under the Corporations and Labour Unions Returns Act.

The Science and Technology Statistics Section carries out an annual survey of all firms conducting or financing R&D. It collects, for example, data on payments made abroad and receipts from abroad for R&D. It also asks firms conducting or sponsoring R&D to indicate payments and revenues in respect of patents, licences and technical know-how. These statistics are provided by industrial classification when sufficient observations exist to ensure confidentiality. Table 1 is an example of the kind of information provided by this Section.

The Balance of Payments Sub-division collects annual data on financial transactions between Canada and other countries. A special survey conducted every four years establishes the types of payments made for various business services, and the countries with which the transactions are conducted. This survey has been annual since 1983. Table 2 gives an example of the data produced by the 1981 quadrennial survey.

Table 1. Technological Balance of Payment for Selected Industries, 1981

Selected industries	Payments	Receipts	Net Payments
	millions of dollars		
Mines and wells	37	5	32
Manufacturing industries	503	230	273
Business machines	202	82	120
Communication equipment	40	57	17(1)
Petroleum products	13	3	10
Chemical products	65	10	55
Other manufacturing industries	33	4	29
Services	9	33	24(1)
Total	547	268	279

(1) Net Receipts

Source: **Science and Technology Indicators, 1984**, Statistics Canada, Catalogue No. 88-201.

Table 2. Receipts and Payments for Commercial Services, by Country of Control, 1981

Item	Total	Country of Control:		
		Canada	U.S.A.	Other
		millions of dollars		
Receipts				
Consuting and other professional services	687	595	60	32
Insurance premium and other insurance transaction	133	13	45	75
Management and administrative services	126	80	40	6
Scientific research and product development	79	28	51	-
Commissions	64	12	28	24
Royalties, patents, trademarks and film location	41	22	12	7
Advertising and promotional services	40	30	6	4
Computer services	22	15	7	-
Equipment rentals	8	3	3	2
Franchises and similar rights	5	3	2	-
Other services	806	98	666	42
Total, survey results	**2,011**	**899**	**920**	**192**
Payments				
Royalties, patents, trademarks and film location	769	60	620	89
Tooling and other automotive charges	638	-	638	-
Consulting fees and other professional services	603	395	192	16
Consulting services and other professional services	603	43	529	31
Scientific research and product development	280	48	208	24
Insurance Premium and other insurance transaction	203	15	136	52
Commissions	168	75	62	31
Computer services	63	3	58	2
Equipment rental	52	3	45	4
Advertising and promotional services	42	18	21	3
Franchises and similar rights	12	5	6	1
Other services	189	42	128	19
Total, survey results	**3,622**	**707**	**2,643**	**272**

Source: **System of National Accounts, Quartely Estimates of the Canadian Balance of International Payments, 1983,** Statistics Canada, Catalogue No.67-001, 1983.

The Corporations and Labour Unions Returns Sub-Division collects and publishes annually financial data on corporations whose gross annual revenues exceed $500,000, or whose assets exceed $250,000. However, in consequence of a recent amendment of the Corporations and Labour Unions Returns Act, financial data will be collected in future from corporations whose gross annual revenues exceed $15 million, or whose assets exceed $10 million. The purpose of the Sub-Division's activities is to evaluate the extent and effects of ownership and control of Canadian corporations by non-residents. Table 3 is an example of the data produced by this Sub-division.

Table 4 presents the same payment types, but for non-residents of the United States for the manufacturing sector. A substantial proportion of these payments could prove to be payments for technology transfers.

Table 3. Payments to Non-residents by Reporting Corporations, by Payment Type and Country of Control, 1980

Payment type	Corporations under foreign controle	Corporations under canadian controle	All corporations
		millions of dollars	
Dividends	2,360.3	554.2	2,914.5
Interest	839.5	777.6	1,617.1
Rent	66.9	148.9	215.8
Royalties and similar payments:			
Copyrights	71.9	20.7	92.5
Patent of invention	66.7	10.4	77.1
Industrial Design	56.8	7.5	64.3
Trademarks and trade names	132.9	12.1	145.0
Other	364.0	124.5	488.4
Total	**692.2**	**175.2**	**867.4**
Payments for exercise of production, distribution and sales franchises and similar rights	52.2	14.9	67.1
Advertising and sales promotion	39.6	19.2	58.8
Payment for or in respect of:			
Scientific Research	86.8	27.7	114.5
Product and process development research	166.4	3.6	170.0
Total	**253.1**	**31.3**	**284.5**
Insurance premiums and related charges	19.5	5.2	24.7
Management and administrative fees	366.0	59.3	425.4
Salaries, fees and other remuneration to officers and directors	13.9	6.9	20.7
Annuities, pensions and similar payments	0.6	0.8	1.4
Fees ande charges for professional services:			
Engineering services	350.9	13.1	364.0
Architectural services	0.1	0.5	0.6
Legal services	7.3	14.5	21.8
Accounting services	15.6	0.5	16.1
Auditing services	2.6	0.8	3.4
Total	**376.4**	**29.4**	**405.8**
Consulting fees and other charges not included in any of the above payments	368.6	38.3	406.9
Total, all payments	**5,448.8**	**1,861.2**	**7,310.0**

Source: **Corporations and Labour Unions Returns Act, Report for 1980, Part I - Corporations,** Statistics Canada, Catalogue No. 61-210, 1984.

Table 4 Payments to Resident of the United States by Reporting Corporations by 26 Payment Types, for the Manufacturing Sector, 1981 and 1982

	Payment type	1981	1982
		$ 000,000	
1	Dividends	1,253.8	1,333.8
	Interest:		
2	Debentures and bonds	61.1	115.1
3	Bank loans	17.6	28.6
4	Other	378.9	335.0
	Rent:		
5	On real property in Canada	1.4	1.8
6	On equipment	37.6	26.5
	Royalties and similar payments:		
7	Copyrights	17.5	9.7
8	Patents of invention	55.6	59.0
9	Industrial design	50.8	53.1
10	Trademarks and trade names	72.5	69.3
11	Other	180.5	169.3
12	Payments for exercise of production, distribution and sales franchises and similar rights	13.6	12.9
13	Advertising and sales promotion	27.5	26.1
	Payments for or in respect:		
14	Scientific research	30.5	24.1
15	Product and process development research	129.0	140.4

Table 4 Payments to Resident of the United States by Reporting Corporations by 26 Payment Types, for the Manufacturing Sector, 1981 and 1982 (concluded)

	Payment type	1981	1982
		$ 000,000	
16	Insurance premiums and related charges	12.4	14.6
17	Management and administrative fees	222.1	233.1
18	Salaries, fees and other renumeration to officers and directors	4.8	5.0
	Annuities, pensions and similar payments:		
19	To officers and directors	0.1	0.3
20	To shareholders holding more than 5% of any class of issued share	..	..
	Fees and charges for professional services:		
21	Engineering services	338.1	435.0
22	Architectural services	7.2	0.1
23	Legal services	2.3	2.2
24	Accounting services	13.5	18.1
25	Auditing services	0.7	0.7
26	Consulting fees and other charges not included in any of the above payments	363.1	423.2
	Total, all payments	**3,292.3**	**3,536.9**

Source: **Corporations and Labour Unions Returns Act, 1982.** Statistics Canada, Catalogue No. 61-210, June 1985, page 252, Table 13.